**1. Introduction**

Due to the frequent energy crisis and environmental pollution, it is important to develop new energy to lessen our dependence on traditional resources like oil, gas and coal and to do it without as much damage to the environment. It is well known that wind power is gradually becoming the leading role of green energy [1]. Using the wind power to generate electricity is receiving increasing attention and has a lot of benefits, but it also has a disadvantage: wind turbine blade as the critical component of the wind turbine are harder to maintain.

Due to the blade's external environment and complex forces, it is highly prone to material failure. Once failure occurs, we need to diagnosis, it often seriously affect the electric energy production and cause serious economic losses [2]. To improve the reliability of the wind turbine, it is urgent to develop the fault diagnosis method of wind turbine blades.

**There have been several physics-based different methods, such as ﬁber-optic sensing method[3], impedance technique [4], ultrasonic waves[5], vibration and thermal imaging[7] , acoustic emission[6].** When acrack occurs in the blade, radiation of transient elastic waves is produced by a sudden redistribution of stress, namely acoustic emission (AE). AE-based detection method has become a widely used non-destructive assessment method of the fault. A.G. Dutton, M. J. Blanch et al[8] used acoustic emission technology to evaluate the blade state and detect damage, and concluded that the acoustic emission technology can reflect the conclusion of the blade damage process. Wenchao Du and Zongbai Deng [9] used wavelet analysis to process acoustic emission signals, and distinguished different types of damage and materials according to the characteristics of the largest spectral coefficient layer after wavelet decomposition, the spectrum of reconstructed signals, and energy information. The key to fault diagnosis of wind turbine blades is the identification and classification of blade faults. Joshuva et al. extracted statistical features from original vibration signal and carried out feature selection and classification using decision tree algorithm. Jingen Rao uses acoustic emission technology to detect the damage status of wind turbine blades, and uses SVM (Support Vector Machine) to identify two types of damage modes of the blade[10]. However, in the process of classification model training, it is found that the acquisition of faulty samples is often difficult, resulting in a serious imbalance between the number of normal and faulty samples in the training set, thereby causing poor reliability and inaccuracy.

Considering the deficiencies of the common methods above, a fault diagnosis method of blade based on improved SVDD(Support Vector Data Description) was designed. Recently, a significant part of literature concerns SVDD and its applications [11-13]. For fault diagnosis of wind turbine blade, the number of fault samples grows dynamically over time. In order to improve the recognition accuracy of the model, it is necessary to add new samples to the original sample set to retrain and update the classification model. If all samples are blindly retrained, the length of training will increase exponentially as the number of samples increases. To this end, some scholars have proposed an incremental SVDD (Incremental SVDD, ISVDD)[14-15]. For example, Feng et al. proposed an online recognition method of HRRP for radar systems based on ISVDD. However, to the best of our knowledge, ISVDD is still rarely applied in current fault diagnosis of wind turbine blade.

This paper presents an fault diagnosis method of the wind turbine blade using improved ISVDD.

The remaining part of the paper is organized as follows. Section 2 brieﬂy reviews the formulation of SVDD; Finally, conclusions are summarized in Section 4.

**2. The basic theory of SVDD**

SVDD was proposed by Tax and Duin (2004) to solve the original one-class classiﬁcation problem. The basic idea is to construct a spherically shaped decision boundary that envelops most of the data of interest, with a smaller set of support vectors describing the boundary. Given a set of data pointsin the d-dimensional real (or input) space , the objective is to minimize an objective function that depends on the radius R of a sphere and its center a.

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Here the parameter C controls the trade-off between the volume and the errors while  are slack variables which make the classiﬁer ‘soft-margin’, i.e. allow some possibility of outliers in the training set.

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